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(71) Applicant *(for all designated States except US)*: NOVA MEDICAL PTY. LIMITED [AU/AU]; Piper Bakewell & Piper, 80 King William Street, Adelaide, S.A. 5000 (AU).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : WALLACE, Allan, Kenneth [AU/AU]; 21 Cochrane Terrace, Prospect, S.A. 5082 (AU).

(74) Agent: F.B. RICE & CO.; 28A Montague Street, Balmain, NSW 2041 (AU).

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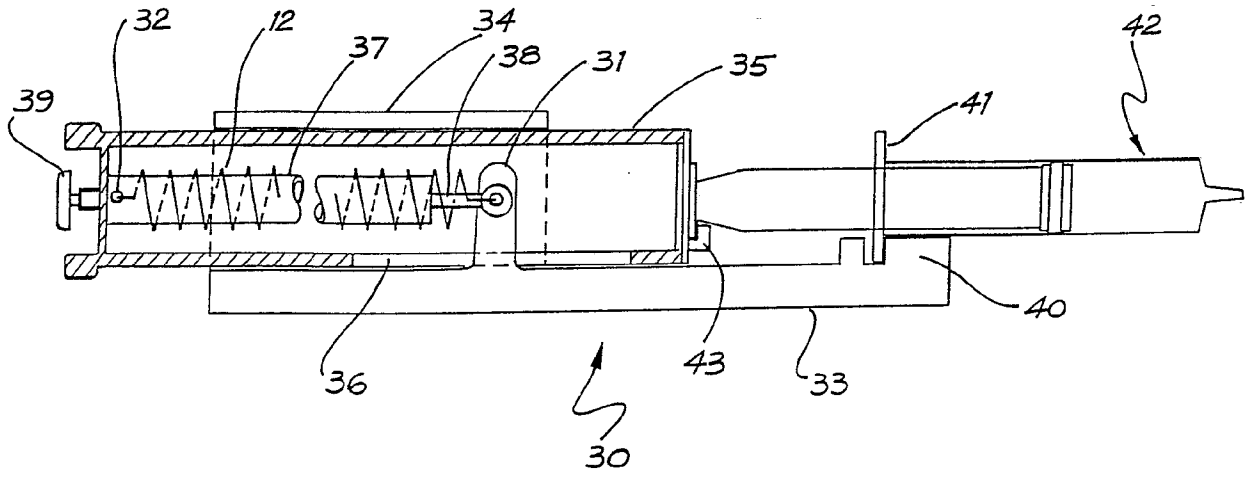
(54) Title: SLOW DELIVERY INJECTION DEVICE



(57) Abstract

A self-contained device (30) which holds the body (42) of a syringe generally axially aligned with an internal damper unit (37) having an enveloping tension spring (12) acting between a base part of the device (30) and a piston (35) which generally houses the damper (37) and spring (12). The damper (37) includes an externally adjustable damping control (39) for setting the damping resistance to compression of the damper (37). Extension of the damper (37) offers substantially no resistance other than that required to extend the spring (12). The device can be loaded with a filled syringe (42) and will then slowly discharge the syringe at a selectable rate according to the setting of dial (39).

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"SLOW DELIVERY INJECTION DEVICE"

The present invention relates to a slow injection device and more particularly to a manually operable slow injection device.

BACKGROUND ART

It is reported that the vast majority of adverse drug reactions due to the bolus injection of drugs by hand via a syringe are due to the rate of injection, not to the species of drug. Ideally, the contents of a syringe need to be delivered over a number of minutes. Clinical practice is such that this rarely occurs due to time pressure on the staff who must operate the syringe manually.

Electrically operated syringe pumps are known however these machines are of considerable complexity and are designed to inject very small doses of medicine with considerable accuracy over a long period which may be up to 24 hours. Such syringe pumps do not provide the cheap, simple and manually operated device suitable for the slow injection of drugs over a period of up to, say, 15 minutes.

DISCLOSURE OF THE INVENTION

The present invention consists in a slow injection device comprising holding means to hold a syringe, manually actuable energy storage means adapted to apply a force to a syringe held by the holding means to bias the syringe to a condition in which the contents thereof are expelled therefrom, and rate controlling means to control the rate of release of energy from the energy storage means.

The syringe for use in the slow injection device according to the present invention will preferably be of a conventional type except that a short length of plastic tubing will be provided between the syringe and the cannula. The cannula may be positioned in the patient or intravenous line and the syringe placed in the slow

injection device located on a bedside table or other location adjacent the patient.

The holding means may be any suitable mounting capable of receiving a conventional syringe while leaving the barrel and pistons of the syringe free for relative movement between a condition in which there is space within the syringe containing a liquid to be injected and a condition in which the contents of the syringe will have been expelled therefrom (the latter being hereinafter called a closed condition).

The energy storage means are manually actuable to raise the energy level therein sufficiently to bias a syringe to the closed condition. The energy storage means might comprise a spring such as a helical tension or compression spring, a gas spring or a biphase gas/liquid equilibrium mixture, e.g., a refrigerant. In the latter case the gas/liquid mixture would provide a driving force dependent upon temperature rather than displacement as is the case with a spring.

The rate controlling means are required to regulate the rate of release of energy from the energy storage device such that the syringe is moved to the closed condition over the desired time. In preferred embodiments of the invention the rate controlling means comprise a hydraulic cylinder arrangement containing an incompressible fluid which is moved through a restricted aperture or a linear or rotary viscous damper. In the former case it is required that there be a reservoir to receive the displaced fluid; in order to save space this reservoir may comprise or include the reverse side of the piston being driven. If desired the hydraulic cylinder may be replaced by bellows or a bellowphragm equivalent.

In another embodiment of the invention the energy storage device may be a spring or the like which drives a pinion through a one way clutch and an adjustable governor

which acts as the rate limiting means. The pinion in turn drives a rack which acts to move the syringe to the closed condition. In this arrangement the governor could be replaced with another form of rate limiting device such as an escapement, a centrifugal governor, a magnetic damper, or a viscous damper such as an oil film damper or an air paddle damper.

In yet a further embodiment of the invention the energy storage device comprises a spring, diaphragm, or an elastic dirigible reservoir connected to a hydraulic ram through an assymetric control valve. Movement of the piston into the barrel of the ram to allow mounting of the syringe in the device according to the invention serves to compress the spring or to distend the diaphragm or dirigible reservoir. The energy stored is then used to return hydraulic fluid through the control valve at a slow rate into the ram and thus slowly move the syringe to the closed condition.

BRIEF DESCRIPTION OF THE DRAWINGS

The following drawings illustrate preferred exemplary embodiments of the invention to be described in detail with reference to the drawings:-

Fig. 1 is a perspective view of a device according to the present invention;

Fig. 2 is a diagrammatic representation (not to scale) of the device of Fig. 1;

Fig. 3 is a sectional view through an alternative form of rate limiting means for inclusion in the device of Fig. 1;

Fig. 4 is a sectional view of an alternative embodiment of the invention; and

Fig. 5 is a detailed sectional view of a component of the device of Fig. 4.

BEST MODE OF CARRYING OUT THE INVENTION

The slow injection device 10 comprises syringe

clamping means 11, on energy storage spring 12, and rate limiting means 13.

The syringe clamping means 11 include a first end plate 14 having a vertically extending slot 15 opening into its upper edge and adapted to receive the apertured end of a syringe 16; and a second end plate 17 slidably mounted on device 10 and adapted to bear against the free end of the piston of syringe 16.

The energy storage spring 12 is arranged to bear, directly or indirectly, on an end plate 17 to urge it into contact with the free end of the piston of syringe 16 and in turn to urge the syringe into a closed condition.

The rate of movement of end plate 17 is controlled by the rate limiting means 13. As shown in Fig. 2 the rate limiting means 13 compresses an hydraulic ram 18 having a barrel 19 connected to the device 10 and a piston 21 connected to end plate 17. The barrel 19 is in fluid communication with a dirigible reservoir 22 through an assymetric control valve 23.

In operation the end plate 17 is drawn back from end plate 15 to allow the insertion of syringe 16 into the device 10. This movement compresses spring 12 and simultaneously forces hydraulic fluid from ram 18 through the control valve 23 into the dirigible reservoir 22. The spring 12 then serves to urge the syringe 16 into a closed condition however the rate at which this is achieved is controlled by the rate at which hydraulic fluid is permitted to flow from the reservoir 22 back to the ram 18 through the control valve 23.

Fig. 3 shows an alternative arrangement of rate control means 13. In this arrangement the dirigible reservoir 22 is dispensed with and the hydraulic fluid flows from ram 18 through a control valve 24 back into the ram 18 on the reverse side of piston 21. The piston 21 of hydraulic ram 18 includes one way valve 25 to allow ready

installation of a syringe 16 into the device 10.

The slow injection device 30 shown in Fig. 4 includes a helical tension spring 12 attached at one end to lug 31 and at the opposite end to anchor 32. The lug 31 is rigid with base art 33 which includes a generally cylindrical housing portion 34 at one of its ends.

Held telescopically within the housing portion 34 is a piston 35 being substantially fully enclosed with the exception of a longitudinally running slot 36 which accommodates the lug 31. The anchor 32 is at an internal end of the piston 35, the anchor 32 also locating one end of a hydraulic damper unit 37. The opposite end of the damper unit 37 being a damper rod 38, is attached to the lug 31.

The damper unit 37 provides an hydraulic resistance to its longitudinal movement being adjustable by way of. adjustment knob 39.

The base part 33 further includes a syringe body holding portion 40 adapted to restrain the finger plate 41 of a syringe 42. The syringe body holding portion 40 is adapted to take a range of standard syringes 42.

A thumb plate engaging portion 43 is attached to one end of the piston 35 proximate the syringe body holding portion 40. The thumb plate engaging portion 43 is adapted to hold, and push under the action of the spring 12, the thumb plate and thus piston of the syringe 42.

Fig. 5 shows the damper unit 37 in more detail. The damper unit 37 includes an internal cylindrical bore 44 and a mating piston 45 in close engagement. The piston 45 preferably includes a low friction seal such as PTFE produced cap seal. The piston 45 is connected to the damper rod 38 extending to the exterior of the body of the damper unit 37. The piston 45 includes an internal valve mechanism 46 which allows asymmetric damping characteristics, that is, there is substantialy damping

only in one longitudinal direction of movement of the piston 45 relative to the bore 44. The direction of damping will be as the damper unit 37 compresses.

The adjustment knob 39 is connected to an adjacent needle valve 47 which is moved relative to its seat by rotation of the adjustment knob 39 so as to provide a variable diameter fluid flow aperture from the internal volume of the bore 44 and an external fluid flow line 48. The fluid flow line 48 extends along one edge of the body of the damper unit 37 and returns into the internal volume of the bore 44 at the end of the body opposite the needle valve 47. A closed cell foam annular block 49 is included so as to make up the long change of displaced fluid equating to the volume of the piston rod 38 within the internals of the damper unit 37 at different positions of extension of the unit as a whole. Thus no air volume is required within.

In operation the device 30 forms substantially the same task as the previously described device 10.

It will be recognised by persons skilled in the art that numerous variations and modifications may be made to the invention as described above without departing from the spirit or scope of the invention as broadly described.

CLAIMS:

1. A slow injection device comprising holding means to hold a syringe, manually actuable energy storage means adapted to apply a force to a syringe held by the holding means so as to bias the syringe to a condition in which the contents thereof are expelled therefrom, and rate controlling means controlling the rate of release of energy from the energy storage means.

2. A device as in claim 1 wherein the energy storage means is a steel spring.

3. A device as in claim 1 wherein the energy storage means is compressed gas.

4. A device as in claim 1 wherein the rate controlling means is a fluid damper.

5. A device as in claim 1 wherein the rate controlling means and energy storage means are respectively a elongate fluid damper and an elongate helical steel spring concentric of the damper, the fluid damper having a damper rod extending telescopically from one end and a first spring attachment device attaching one end of the spring to an end of the damper rod and a second spring attachment means attaching an opposite end of the spring to a distal end of a body of the fluid damper.

6. A device as in claim 5 wherein the fluid damper includes a damping force adjustment means adjustable externally of the damper and the damper having substantially no damping resistance in one direction of telescopic movement of the damper rod and adjustable damping resistant in the other telescopic direction of movement of the damping rod.

7. A device as in claim 6 wherein the holding means is adapted to hold the body of a syringe and is rigidly connected to the damper rod so as to hold the syringe approximately parallel to and concentric with the damper rod and the device further comprises a syringe thumb plate

engaging portion approximately concentric of the damper rod and rigidly connected to the body of the damper and wherein the spring is a tension spring such that the thumb plate engaging portion can be withdrawn away from the syringe holding means thereby extending the spring and moving the damper rod in the telescopic direction of substantially no damping resistance so as to allow placement of a standard syringe in the device and thence control operation of the syringe to discharge liquid within the syringe at a controlled rate proportional to the selected damping adjustment.

8. A device as in claim 6 further including a syringe held by the holding means generally aligned with the damper rod so as to provide controlled forced egress of liquid within the syringe at a rate dependent upon the selected damping force adjustment.

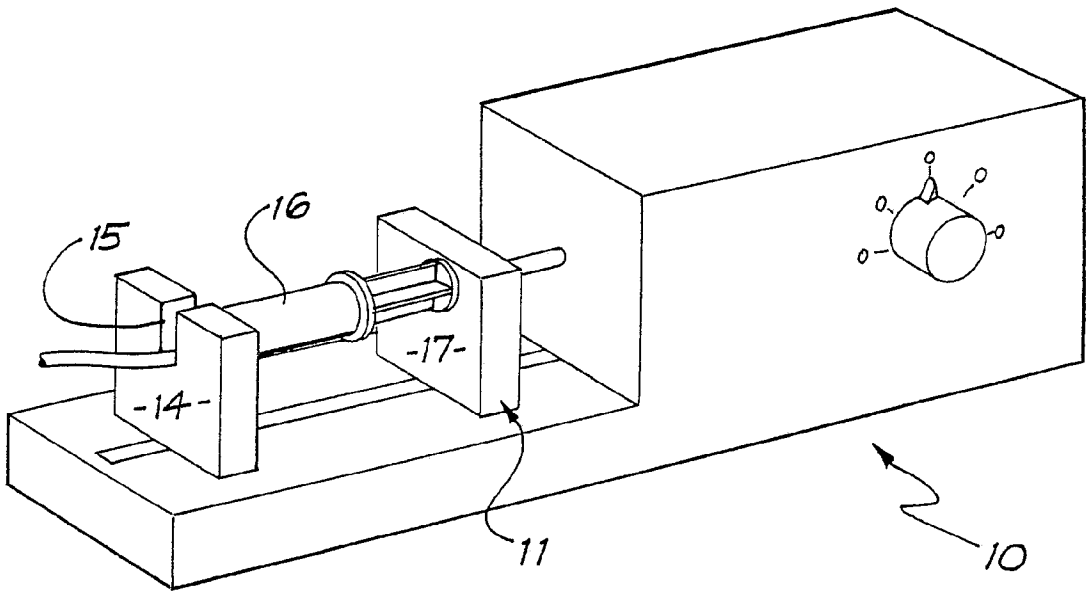

FIG. 1

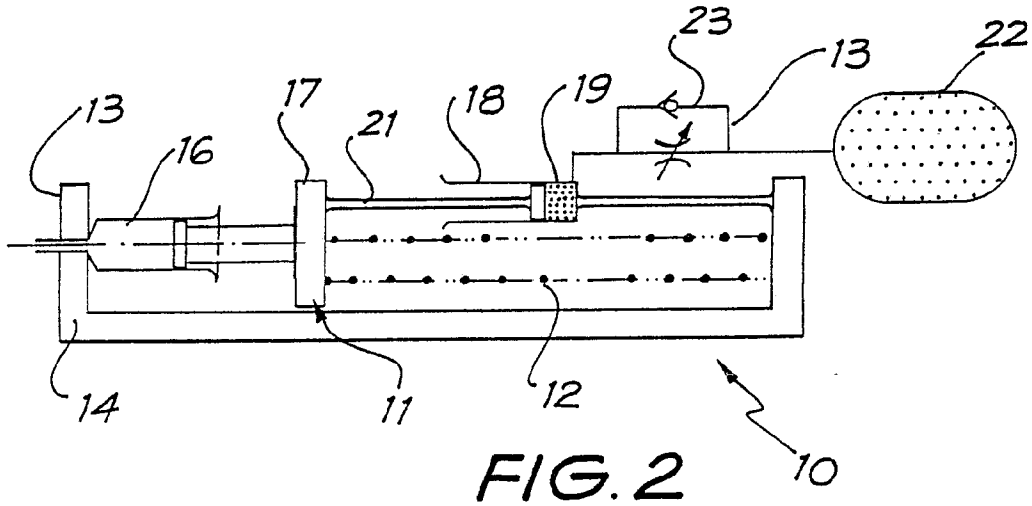

FIG. 2

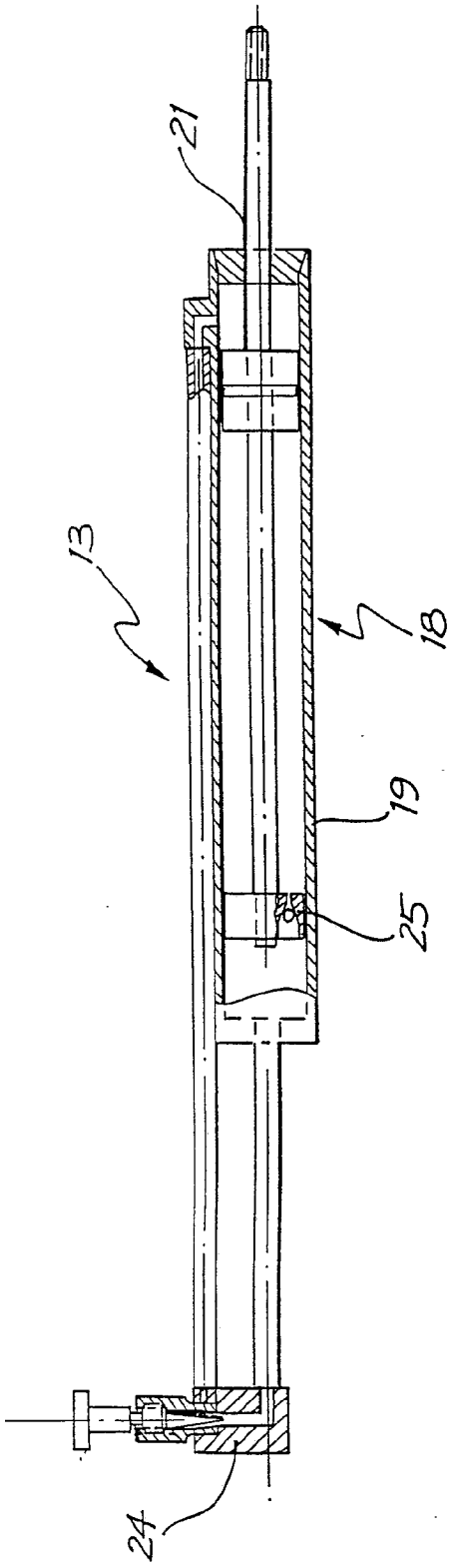

FIG. 3

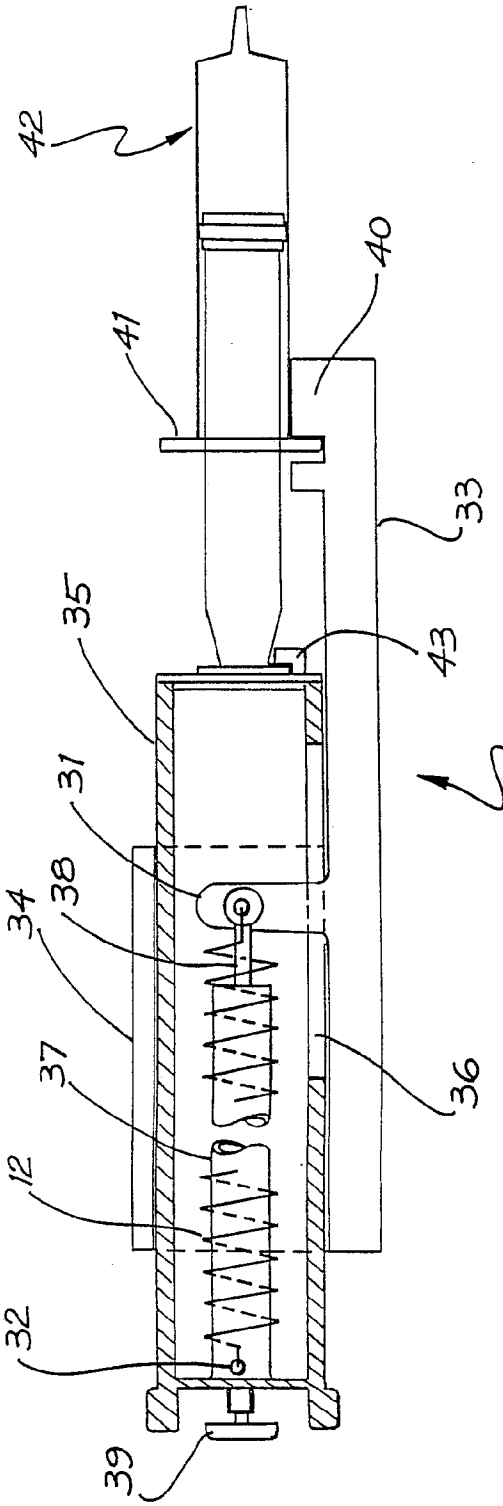

FIG. 4

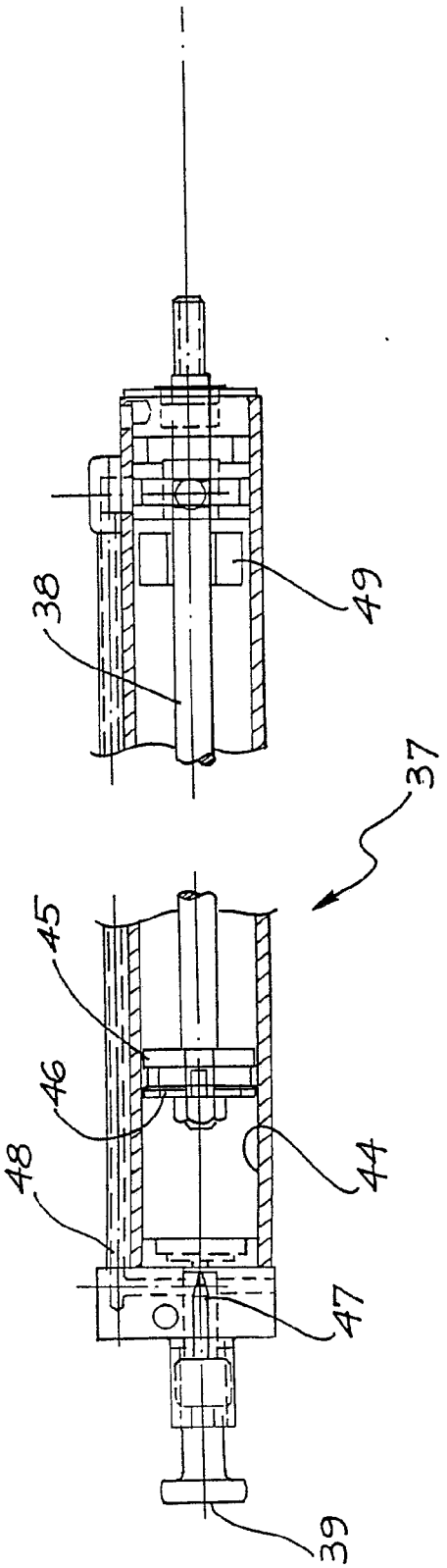

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 88/00203

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] A61M 5/20, 5/315

II. FIELDS SEARCHED

Minimum Documentation Searched

Classification System	Classification Symbols
IPC	A61M 5/20, 5/315

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	GB,A, 1026593 (NASH et al) 20 April 1966 (20.04.66)	(1,2,3,4)
X	US,A, 3474787 (GRANT) 28 October 1969 (28.10.69)	(1,2,4)
X	US,A, 4437859 (WHITEHOUSE et al) 20 March 1984 (20.03.84)	(1,2,4)
X	US,A, 4430079 (THILL et al) 7 February 1984 (07.02.84)	(1,2,4)
X	US,A, 3605745 (HODOSH) 20 September 1971 (20.09.71)	(1,3,4)
X	US,A, 3279653 (PFLEGER) 18 October 1966 (18.10.66)	(1,2)
X	US,A, 3886938 (SZABO et al) 3 June 1975 (03.06.75)	(1,2)

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
9 September 1988 (09.09.88)	23 September 1988 (23.09.88)
International Searching Authority	**Signature of Authorized Officer**
Australian Patent Office	

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 88/00203

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members
US 3474787	DE 1566606
US 4430079	US 4597754, US 4298000, DE 2945405, FR 2441150, GB 2037377, JP 55066366, US 4202333, CA 1227392

END OF ANNEX